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2,861,630

DRUMS AND CABLES

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3 Sheets-Sheet 1

Fig. 1.

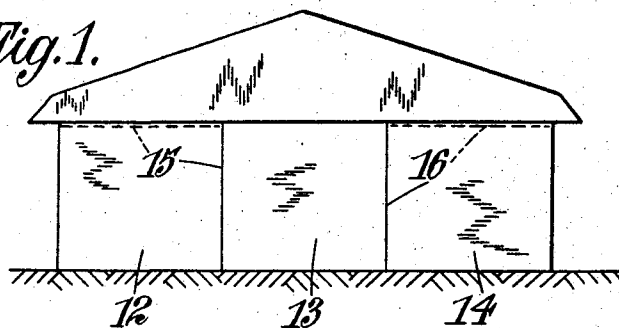


Fig. 2.

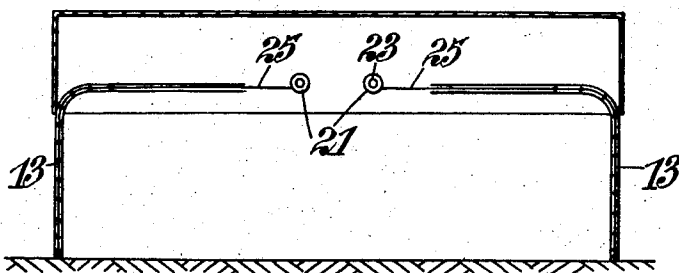
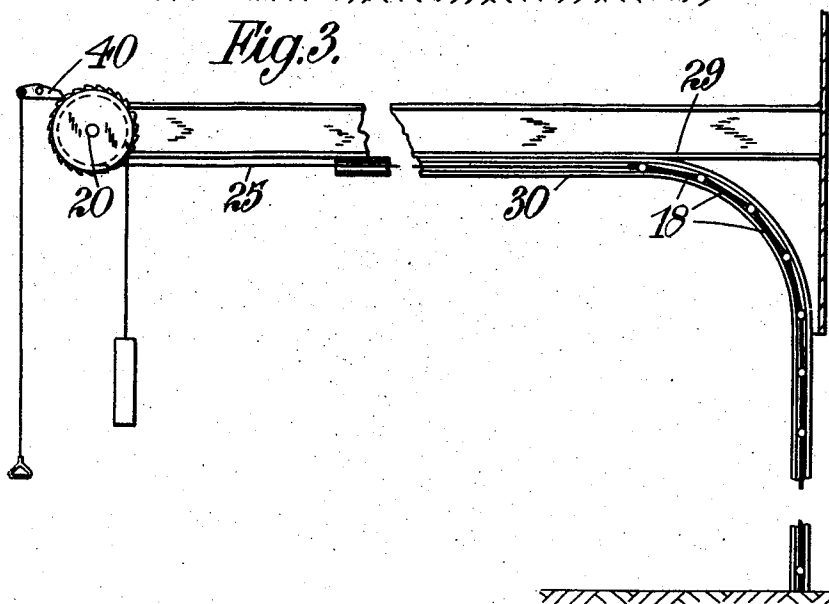


Fig. 3.



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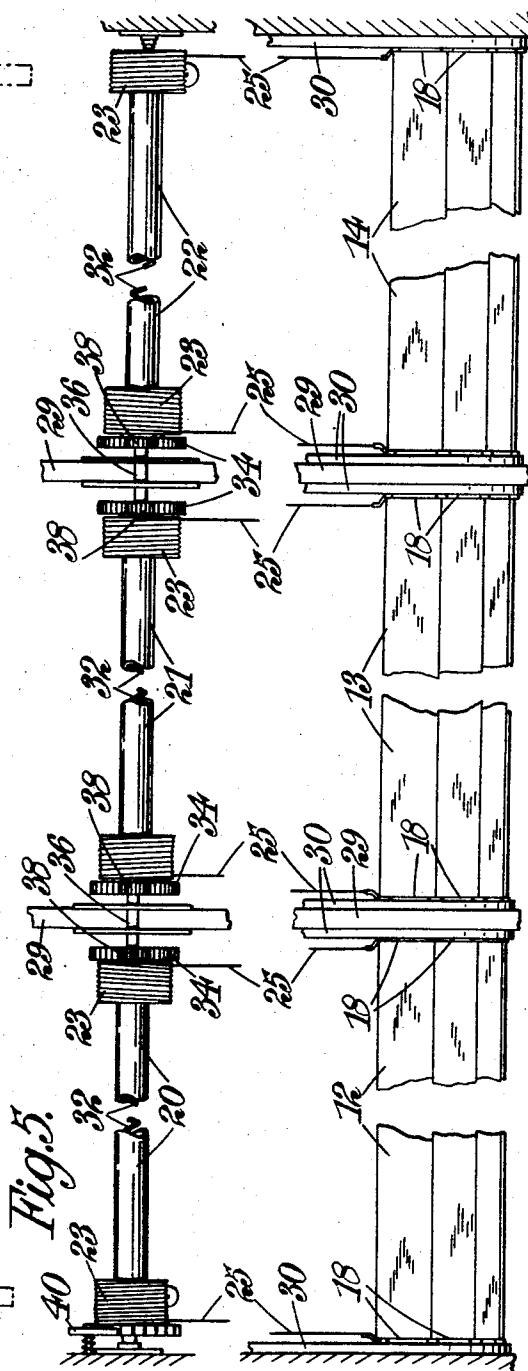
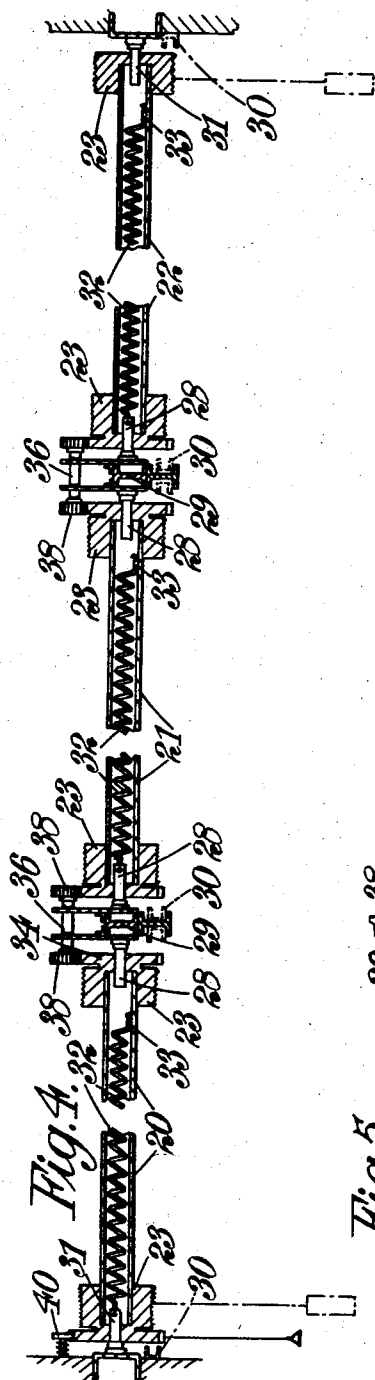
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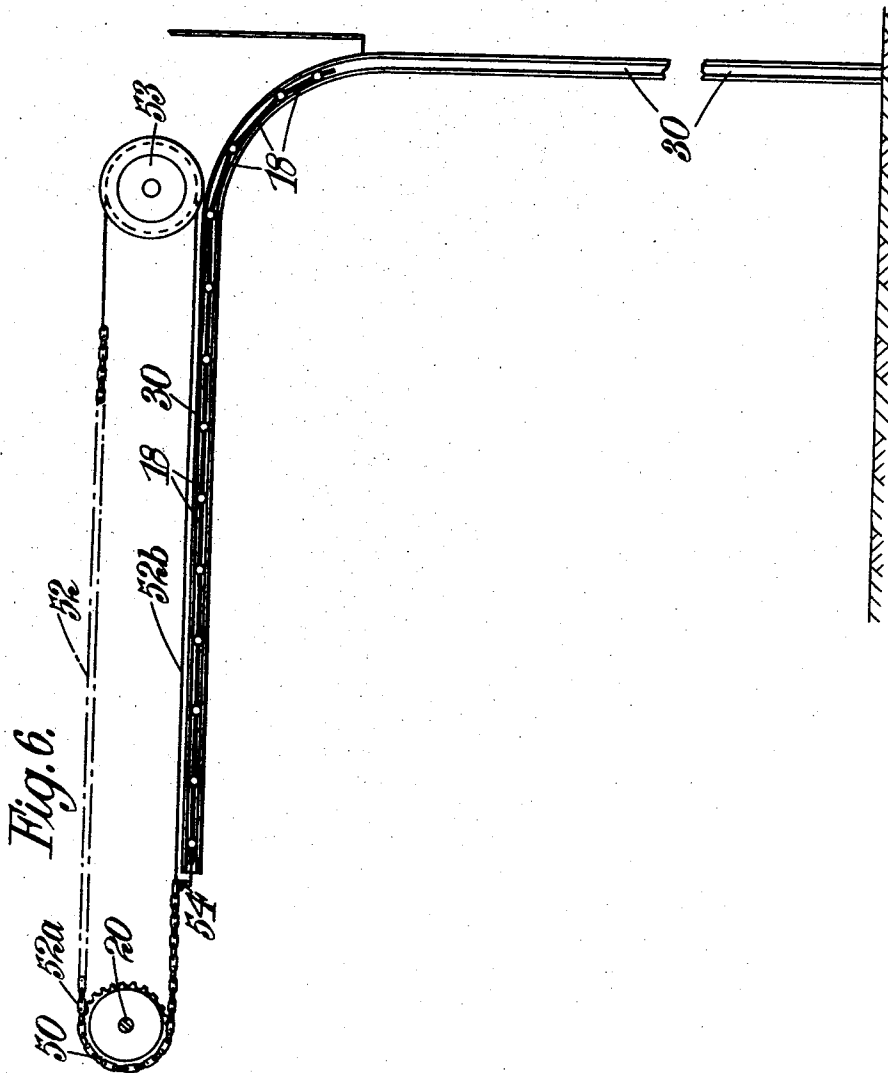
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DRUMS AND CABLES

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3 Sheets-Sheet 3



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DRUMS AND CABLES

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4 Claims. (Cl. 160—113)

The invention relates to means for counterbalancing flexible doors or shutters of the kind which, on opening, move from a vertical attitude along a curved path into, or mainly into, a horizontal attitude and is concerned with means of the type in which a helical torsion spring (or several such springs which may be nested one within the other) is employed to provide a force counterbalancing wholly or partly the weight of the door, the spring being progressively energised as the door is moved to the closed position.

It is an object of the invention to provide an improved construction of counterbalancing means of the above type which tends to lift the side edges of the door equally.

The invention provides flexible door or shutter counterbalancing means of the above type in which the spring (or springs) is contained within, and exerts a torque on, a hollow shaft or the equivalent which provides or carries two cable drums, chain sprockets or like means for applying a positive pull to a cable, chain or like flexible member, spaced apart along the shaft and to which are secured respectively two lifting cables, chains or the like, which are connected to the door at positions spaced apart across the width thereof.

Preferably the spacing of the drums or the like means equals the spacing of the connections of the flexible members to the door. For example the members may be attached to the door at, or adjacent, its side edges and the drums may be correspondingly spaced. The flexible door may be of a construction in which chains or equivalent link mechanisms are provided at the side edges of the door and the door is composed of horizontally extending panels which are attached at their ends to the chains. The flexible lifting members of the present invention may be connected to the chains, preferably at the upper ends thereof.

The flexible members may be wound around the drums and each have a single run attached at its end to the door. Alternatively the members may be endless (e. g. endless chains running over sprocket wheels on the hollow shaft and over idler sprockets or pulleys on a second shaft) and have two runs, to one of which the door may be connected or attached. The endless members may be constructed as a combination of driving chains and cables. The idler pulleys may be located over the doorway and the driving shaft spaced back therefrom by a distance at least equal to the height by which the door is to be lifted or the reverse arrangement may be used.

In one construction according to the present invention there are two or more flexible doors side by side and each door has its own counterbalancing spring, shaft, drums and cables. In one form of this construction the shafts are interconnected for rotation in unison thereby to ensure simultaneous opening and closing of the doors. In some cases when there are two or more doors as just described it may be necessary or desirable to provide fixed means between the shafts for absorbing the reaction of at least one of the springs and for such an arrange-

2

ment the shafts may be interconnected by a gear train. For example the arrangement may be that the shafts are aligned and the interconnection comprises a gear drive from one of the shafts to a layshaft and a return drive from the layshaft to the other of the shafts.

There may be included a counter-weight connected by cable or the like to a drum on the shaft, or on one of the shafts when there are more than one, and arranged to augment the force of the spring or springs. The cable of the counter-weight may be wound on to one of the drums employed for the lifting cables and the arrangement be that as one of the cables winds off the drum, in use, the other cable winds on the same section of the drum.

The spring or springs together with the counter-weight if provided, may provide a force which overbalances the weight of the door or doors and in that event releasable means for holding the door closed against the springs may be provided.

The shaft, or at least one of the shafts when there are more than one, may be supported for rotation on fixed stub shafts at its ends (or a single through shaft) and one of the stub shafts (or one end of the through shaft) may provide the fixed reaction means for the spring.

The invention is particularly suited for application to the doors of hangars for aeroplanes and like large structures. Two specific embodiments of this application of the invention will now be described by way of example and with reference to the accompanying drawings in which:

Figure 1 is a front view of a hangar,

Figure 2 represents a section through the hangar,

Figure 3 is a view, to an enlarged scale, of part of the door counter-balancing means at one end of the hangar,

Figure 4 is an elevation of the counter-balancing means for the doors at one end of the hangar,

Figure 5 is a plan view of the counter-balancing means shown in Figure 4, and

Figure 6 is a view, corresponding to Figure 3, of an alternative construction.

The hangar to which these examples are applied has rectangular doorways at opposite ends, each doorway being provided with three flexible doors 12, 13, 14 positioned side by side. Between the two pairs of adjacent doors at each end there are two upright 15, 16 which provide guideways for the doors and are pivoted to the door frames at their upper ends. When the doors are open the uprights may be swung outwardly and upwardly as shown in chain lines in Figure 1 so as to leave a clear opening the full width of the three doors.

Each door is divided into horizontal panels and embodies chains 18 at the sides of the door to which the door panels are attached. The doors move, in opening, from a vertical position around a 90° arc into a horizontal position beneath the roof of the hangar.

In the first example (Figures 1-5) there is, at a position at about the centre of the length of the hangar and immediately below the roof, for each door, a transverse tubular shaft 20, 21, 22, carrying on its ends drums 23 for lifting cables 25. The cables are attached to the upper ends of the chains 18. The shafts 20, 21, 22 for each set of doors are aligned across the hangar. The ends of the centre shaft 21 and the inner ends of the outer shafts 20, 22 are supported on stub shafts 28 attached to beams 29 which also carry guideways 30 for the doors, the guideways receiving rollers on the pivots of the chassis 18. The outer ends of the outer shafts 20, 22 are similarly supported on stub shafts 31 attached to supports at the sides of the hangar. Contained within each of the shafts there is a helical spring 32 of which one end is attached to the shaft (as indicated at 33) and the other to one of

the stub shafts 28 or 31 on which the shaft is supported. The spring is capable of providing a torque more than sufficient to counterbalance the door.

Spur gears 34 are secured to each end of the centre shaft 21 and to the inner ends of the outer shafts 20, 22. Layshafts 36 running in bearings on the beams 29 have gears 38 which mesh with the gears 34 on the adjacent ends of the centre and outer shafts and so provide driving connections between the three shafts ensuring that they will rotate in unison. Releasable pawl and ratchet means 40 engaging one end of the shaft assembly are provided for holding the shafts against the springs when the doors are in the closed position. Accordingly to open the doors it is only necessary to effect release of these means when all three of the doors will open automatically.

It is to be understood that the arrangements at the two ends of the hangar are alike.

Figure 6 shows a modification of the above example. In this modification the drums 23 are replaced by sprocket wheels 50 and the lifting cables 25 are replaced by endless bands 52. The bands pass over idler pulleys 53. The bands may be constructed wholly of chain but in the construction illustrated they are composed partly of chain (52a) and partly of cable (52b), the chain being in driving engagement with the sprockets 50. The cable is attached, at 54 to the upper end of the chain 18. The drawing shows the door in the fully raised or open position. If desired the sprocket wheels 50 and the pulleys 53 may be transposed so that the driving sprockets and their spring mechanisms are located more nearly over the doorway and not over the centre of the hangar.

I claim:

1. Counter-balance means for a plurality of flexible, upwardly opening side-by-side doors comprising an assembly of a corresponding number of shafts arranged in alignment above and inwardly of the doors, one of said shafts for each door; means for supporting the shafts for rotation, two drums fixedly mounted on each shaft and spaced apart along the length thereof, two elongated flex-

ible tension members attached at one end to the two drums, respectively, being adapted to be wound therearound on rotation of the drums, and attached at the other end in weight-supporting relationship to the corresponding door, an anchor, a torsion spring acting between the drums and the anchor to exert a torque on the drums, means interconnecting the several shafts for rotation in unison; at least one counter-weight and a supporting elongated flexible member therefor attached to a drum on said assembly of shafts adjacent one end of the assembly, the weight being arranged to augment the springs in counter-balancing the weight of the doors.

2. Counter-balance means as claimed in claim 1 in which the shafts are hollow for the receipt of said springs and a stub-shaft fits into and supports one end of each hollow shaft, said stub-shafts serving as the anchors for said springs.

3. Counter-balance means as claimed in claim 1 in which the combined forces of the springs and counter-weight overbalance the weight of the doors and including releasable means for holding the doors closed.

4. Counter-balance means as claimed in claim 1 in which the means for interconnecting each pair of adjacent ends of the shafts comprise a lay shaft and a gear drive between the lay shaft and each end of the pair.

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